

Application No. 10/025,411
Amendment dated August 14, 2003
Reply to Office Action dated July 24, 2003

Introductory Comments begin on page 3 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 4 of this paper.

Remarks/Arguments begin on page 8 of this paper.

Introductory Comments

Please amend the claims as follows herein.

The Examiner has noted a discrepancy in the numbering of the claims. There was no original claim 7. The Examiner has renumbered the claims to correct this. Applicants request that the claims be amended by changing the dependencies in new claim 10 to claim 9, in new claim 11 to claim 9, new claim 12 to claim 11, and new claim 15 to claim 14.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1. (Original) A method for hydroprocessing a hydrocarbon feedstock, said method employing multiple hydroprocessing zones within a single reaction loop, each zone having one or more catalyst beds, comprising the following steps:

- (a) passing a hydrocarbonaceous feedstock to a first hydroprocessing zone having one or more beds containing hydroprocessing catalyst, the hydroprocessing zone being maintained at hydroprocessing conditions, wherein the feedstock is contacted with catalyst and hydrogen;
- (b) passing the effluent of step (a) directly to a hot high pressure separator, wherein the effluent is contacted with a hot, hydrogen-rich stripping gas to produce a vapor stream comprising hydrogen, hydrocarbonaceous compounds boiling at a temperature below the boiling range of the hydrocarbonaceous feedstock, hydrogen sulfide and ammonia and a liquid stream comprising hydrocarbonaceous compounds boiling approximately in the range of said hydrocarbonaceous feedstock;
- (c) passing the vapor stream of step (b) after cooling and partial condensation, to a hot hydrogen stripper containing at least one bed of hydrotreating catalyst, where it is contacted countercurrently with hydrogen, while the liquid stream of step (b) is passed to fractionation;

- (d) passing the overhead vapor stream from the hot hydrogen stripper/reactor of step (c), after cooling and contact with water, the overhead vapor stream comprising hydrogen, ammonia, and hydrogen sulfide, along with light gases and naphtha to a cold high pressure separator, where hydrogen, hydrogen sulfide, and light hydrocarbonaceous gases are removed overhead, ammonia is removed from the cold high pressure separator as ammonium bisulfide in the sour water stripper, and naphtha and middle distillates are passed to fractionation;
- (e) passing the liquid stream from the hot hydrogen stripper/reactor of step (c) to a second hydroprocessing zone, the second hydroprocessing zone containing at least one bed of hydroprocessing catalyst suitable for aromatic saturation and ring opening, wherein the liquid is contacted under hydroprocessing conditions with the hydroprocessing catalyst, in the presence of hydrogen;
- (f) passing the overhead from the cold high pressure separator of step (d) to an absorber, where hydrogen sulfide is removed before hydrogen is compressed and recycled to hydroprocessing vessels within the loop; and
- (g) passing the effluent of step (e) to the cold high pressure separator of step (d).

Claim 2. (Original) The process of claim 1, wherein the hydroprocessing conditions of step 1(a) comprise a reaction temperature of from 400°F-950°F (204°C-510°C), a reaction pressure in the range from 500 to 5000 psig (3.5-34.5 MPa), an LHSV in the range from 0.1 to 15 hr⁻¹ (v/v), and hydrogen consumption in the range from

500 to 2500 scf per barrel of liquid hydrocarbon feed (89.1-445 m³ H₂/m³ feed).

Claim 3. (Original) The process of claim 2, wherein the hydroprocessing conditions of step 1(a) preferably comprise a temperature in the range from 650°F-850°F (343°C-454°C), reaction pressure in the range from 1500-3500 psig (10.4-24.2 MPa), LHSV in the range from 0.25 to 2.5 hr⁻¹, and hydrogen consumption in the range from 500 to 2500 scf per barrel of liquid hydrocarbon feed (89.1-445 m³ H₂/m³ feed).

Claim 4. (Original) The process of claim 1, wherein the hydroprocessing conditions of step 1(e) comprise a reaction temperature of from 400°F-950°F (204°C-510°C), a reaction pressure in the range from 500 to 5000 psig (3.5-34.5 MPa), an LHSV in the range from 0.1 to 15 hr⁻¹ (v/v), and hydrogen consumption in the range from 500 to 2500 scf per barrel of liquid hydrocarbon feed (89.1-445 m³ H₂/m³ feed).

Claim 5. (Original) The process of claim 4, wherein the hydroprocessing conditions of step 1(e) preferably comprise a temperature in the range from 650°F-850°F (343°C-454°C), reaction pressure in the range from 1500-3500 psig (10.4-24.2 MPa), LHSV in the range from 0.25 to 2.5 hr⁻¹, and hydrogen consumption in the range from 500 to 2500 scf per barrel of liquid hydrocarbon feed (89.1-445 m³ H₂/m³ feed).

Claim 6. (Original) The process of claim 1, wherein the feed to step 1(a) comprises hydrocarbons boiling in the range from 500°F to 1500°F.

Claim 8 7. (Currently Amended) The process of claim 1, wherein the feed is selected from the group consisting of vacuum gas oil, heavy

atmospheric gas oil, delayed coker gas oil, visbreaker gas oil, FCC light cycle oil, and deasphalting oil.

Claim 9 8. (Currently Amended) The process of claim 1, wherein the cetane number improvement occurring in step 1(e) ranges from 2 to 15.

Claim 10 9. (Currently Amended) The process of claim 1, wherein the hydroprocessing catalyst comprises both a cracking component and a hydrogenation component.

Claim 11 10. (Currently Amended) The process of claim 10 9, wherein the hydrogenation component is selected from the group consisting of Ni, Mo, W, Pt and Pd or combinations thereof.

Claim 12 11. (Currently Amended) The process of claim 10 9, wherein the cracking component may be amorphous or zeolitic.

Claim 13 12. (Currently Amended) The process of claim 12 11, wherein the zeolitic component is selected from the group consisting of Y, USY, REX, and REY zeolites.

Claim 14 13. (Currently Amended) The process of claim 1, wherein the second hydroprocessing zone of step 1(e) is maintained at the same pressure as the first hydroprocessing zone of step 1(a).

Claim 15 14. (Currently Amended) The process of claim 1, wherein the second hydroprocessing zone of step 1(e) is maintained at a lower pressure than that of the first hydroprocessing zone of step 1(a).

Claim 16 15. (Currently Amended) The process of claim 15 14, wherein the second hydroprocessing zone of step 1(e) is maintained at a pressure that is from 500 to 1500 psi lower than the pressure in the first hydroprocessing zone.